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Research Report

Alberta Agricultural Research Institute • AARI 1996 Issue Two

Researcher examining genetically engineered canola in tent.

"Pharming" Canola

Researchers engineer canola to produce value-added products

Canola is Alberta's second major crop, behind wheat. In 1995, canola yielded just under $700 million in farm cash receipts. And while a great deal of attention is paid to boosting crop revenues, canola has and continues to be researched in test plots and the laboratory as a source of new, value-added products.

The University of Calgary's Dr. Maurice Moloney leads a research team that has been looking for "alternative products" in the canola plant, products with greatly increased value to the producer and, downstream, to the processor. "What we would like to do first of all," says Moloney, "is to demonstrate the feasibility of producing quite a range of new proteins in the canola seed. We could deliver to the market novel proteins such as pharmaceutical proteins, enzymes, and proteins for livestock meal."

The Alberta Agricultural Research Institute has supported a number of Dr. Moloney's research projects, most of which deal with engineering new proteins into the canola plant. One project funded under AARI's Matching Grants Program is "Crop Diversification by Metabolic Engineering in Canola."

"In this project," explains Moloney, "we placed a protein derived from the salivary glands of leeches into canola. The protein is known as hirudin. It is a blood anticoagulant and is quite valuable as a pharmaceutical. It currently costs $30/gram on the world market to produce. The basic technology can also be used to produce food and industrial products.

"When we introduce alternative genes into oilseeds, we can persuade them to produce compounds and products not normally associated with plants," says Moloney. "One of these potential products is a protein used to stimulate the immune system and combat cancer and other illnesses.

"We developed in this laboratory, as far back as 1989, sophisticated techniques for transferring genes into canola. Since then, we have been able to take genes from sources like bacteria, yeasts, animal sources, and so on. Although the process is sophisticated, it more simply involves taking small pieces of DNA and getting that DNA into the plant cell, and not only into the plant cell, but actually into the existing DNA of the plant – such that it is indistinguishable from the existing genetic information. So once we produce an engineered canola plant, so to speak, it contains additional DNA, which allows it then

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to produce some of these unusual products."

The technology used with canola can also be applied to other crops. Says Moloney, "We have already moved a little in that direction. The technology lends itself most readily to oilseeds, such as flax and mustard. Our immediate interest is flax. Though not nearly as big a crop as canola, there are many flax producers in Alberta. We also know that our technology works well in condiment mustard, which grows well in southern Alberta."

Dr. Moloney is very optimistic about the potential for commercialization. "Within the past few years, we have formed a company, SemBioSys Genetics Inc., as a result of our patents and discoveries. SemBioSys is a company devoted towards commercialization of these products. We are hoping to market our first product in late 1998, possibly 1999."

RESULTS TO DATE

- Valuable product(s) derived from canola, using genetic engineering.
- Commercialization of venture.

POTENTIAL BENEFITS

- Potential for a whole industry infrastructure for production of pharmaceuticals, enzymes and improved animal feed.

TechTransfer
New Crops for Pig Feed

Alberta peas, pea/canola equal performance of imported soy

Alberta pork has established a reputation as one of the highest quality of its kind in Canada. It, of course, owes part of its appeal to the quality of feed given to Alberta pigs. Traditionally, pigs in the province have been fed rations supplemented with soy, imported from the U.S.A., and wheat. Both are costly. While investigating more cost- effective, equally nutritious pig feeds, Alberta pea meal and pea/canola meal were tested. Previously (in 1987) the Alberta Pulse Growers Commission, in cooperation with the Farming for the Future Program, had shown peas to be a quality protein source for hogs. Since that trial, the Alberta Pool has come up with a product called pea/can meal, which is two-thirds peas and one-third canola.

There has been scientific evidence plus much farmer testimonial on the benefits of peas and canola together. There seems to be a synergism between peas and canola which shows the same or better performance than soy and wheat rations. To verify whether pea and pea/can meals produce real economic and performance benefits, two demonstration projects on separate farms were conducted. Each project was funded under AARI's Farming for the Future On-Farm Demonstration Program.

The objectives of the trials were:

- Analyze the impact and economics of peas and canola as a protein source for hog rations.
- Develop a package that will facilitate extension of the demonstration information.
- Increase domestic use of peas and canola as a protein source for hog rations.
- Show that peas and canola are a viable Canadian alternative.

The Alberta Pulse Growers Commission (APGC) is among a number of AARI's partners in the two projects. Others include the Alberta Pool and the Alberta Canola Producers Commission. Janette McDonald Adam, APGC's General Manager explains, "We were able to demonstrate that pea meal and pea/canola meal are good feed sources for pigs. We are also fortunate to have a good supply. The new feed formulation plant near Camrose built in 1995 helps make the meal readily available."

That is not the only benefit, as McDonald Adam continues, "Peas are also good energy sources. This would replace the energy from higher-priced wheat and barley. They are also high in phosphorus, a costly supplement. Since they are locally grown, cost-effective and consistent in quality, I would expect farmers to look at pea and pea/can meal in the future. This, of course, would be an economic feather in our cap, by replacing imported soy.

"The opportunity to co-operate with AARI, agri-business and farmers makes further research a possibility. In the future, APGC would like to see research on precise nutrient levels of peas, on exact digestible energy levels, and on the economics of feeding pea meal and pea/can meal."

Hypothyroidism in Horses

Researchers find possible causes

CANADIANA

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Foal shows the very crippling effects of hypothyroidism.

The losses incurred by equine disease can be catastrophic to a breeder, both economically and with respect to his or her reputation. One disease syndrome – congenital hypothyroidism and dysmaturity (CHD) – has haunted the horse industry in Western Canada for 10-15 years.

Since the mid-seventies, researchers at the Western College of Veterinary Medicine, University of Saskatchewan, have recognized the syndrome, but have not understood its cause. In 1992, the Alberta Agricultural Research Institute (AARI) approved a research project, under its Matching Grants Program, to characterize the disease. The project – "An Epidemiological Investigation into the Congenital Hypothyroidism and Dysmaturity Syndrome of Foals in Alberta" – was a partnered effort. Additional funding was received from the Standardbred and Thoroughbred Divisions of the Alberta Racing Commission Development Fund, and the Western College of Veterinary Medicine Equine Health Research Fund.

The research had three main objectives:

- To obtain a hypothesis on the cause of CHD in foals.
- To identify factors that predispose individual foals and individual horse farms to CHD.
- To identify factors that relate to death, survival and athletic performance of affected horses.

The team's lead researcher, Dr. Andrew Allen, explains, "The syndrome is characterized by severe thyroid gland insufficiency, and a number of muscular and skeletal irregularities. The foals also have prolonged gestations but with clinical signs of immaturity, thus dysmaturity."

Dr. Allen continues, "In addition to significantly longer gestation periods, nine other variables were found to be associated with CHD syndrome, four of which are considered biologically important. Number one was greenfeed. Pregnant mares fed oats or other cereal crops harvested prior to maturity had 13.1 greater odds of producing CHD foals.

Pregnant mares that did not receive mineral supplement over winter had 5.6 greater odds of producing CHD foals. Any dam that left its 'home farm' during gestation increased the odds of CHD by 4.3, and, finally, pregnant mares that grazed irrigated pasture were more likely to give birth to a CHD foal."

It is well established that greenfeed can accumulate high levels of nitrate or nitrite, which have been associated with changes in thyroid metabolism in animals. Dr. Allen believes CHD could be more widespread. It may occur in cattle and other livestock. He concludes: "Although a number of hypotheses have come out of this study about the causes of CHD, they should not be accepted without controlled experimental verification and epidemiological investigations."

RESULTS TO DATE

- Characterization of hypothyroidism and dysmaturity syndrome in foals.
- Identification of factors that may contribute to the disease syndrome.

POTENTIAL BENEFITS

- May lead to further knowledge of the disease syndrome, and a possible cure.
- High potential revenues to Alberta resulting from a cure.
- Future application to other animals and, possibly, humans.

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Watering the Web

Irrigation Project AARI's First to use WEB Site

Water, water everywhere and no place to stick a sign. According to Rod MacLean, Irrigation Specialist for the Department's Irrigation Branch in Brooks. "Our Farming for the Future project is looking at better ways to deliver water to farmers. But the project involves 13 fields and 11 farmers. There was no sense in placing a sign where it would not be seen. We came up with an alternative idea – for a web site – which will be part of the Eastern Irrigation District's localized web server."

Web sites can provide a great deal of information to users. This is the reason the project staff chose an "electronic sign." Says MacLean, "Farmers need to know as much information as possible about the water on their land. What they want is something up-to-date. One can't get as current as the information highway. Having access to the Internet is also a way of information-sharing, finding out what the producers want, and hearing opinions from out in the field."

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Editor's Note

For this issue only, our regular editorial column will be replaced with a reader survey regarding *"Research Report."* We are attempting to minimize the cost of publication and distribution. ***Therefore, anyone not responding to the survey by December 31, 1996, will be removed from the mailing list for Research Report.***

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